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## The Role of the University of Hawaii Laboratory School in an NSF GK-12 Training Grant

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### Abstract

Research and training are important roles of laboratory schools. Whereas traditional laboratory schools have primarily served in the training of education and psychology students, the University Laboratory School (ULS) at the University of Hawaii-Manoa has been a partner in a National Science Foundation training grant that targets building teaching and communication skills of science graduate students. The training component of the grant is augmented by demonstration and practice in the “safe” environment of ULS. Further, the flexibility provided by the school’s research mission has allowed graduate students to develop and test pilot projects for export to other schools with more constrained curricula. Recommendations for successful partnering of laboratory schools in similar efforts include putting laboratory school faculty in principle investigator (PI) roles, reaching out to community groups, public and private schools, and disseminating data-driven results of partnerships.

## Introduction

### *Historical and Future Roles of Laboratory Schools*

Laboratory Schools have historically had an important role in education and training in the United States (Cassiday & Sanders, 2002; Page & Page, 1981). The first laboratory schools were established during the first half of the 1800s, primarily to provide practical teaching experience for education students (Eubanks, 1931). As subsequent schools were formed, most notably that established by John Dewey at the University of Chicago, they added experimentation and research as functions of laboratory schools (Hughes, 1959; Perrodon, 1955). Following the marked decline in laboratory schools through the 1970s and 80s, the remaining schools identified a range of missions from clinical experience to research (Howd & Browne, 1970; Page & Page, 1981). These missions are still cited by remaining laboratory schools.

Traditionally laboratory schools have functioned in instruction of students, training of preservice and inservice teachers, and research. The location of most laboratory schools on college campuses provides unique opportunities for training and professional development of education students (MacNaughten & Johns, 1993; Miller & Vaughn, 2000). The interactions of laboratory schools with their host institutions have been primarily with colleges of education, education training programs, or child psychology. In some cases, laboratory schools are not well integrated with college or university activities, and their visibility on campus or in the community is not only limited, but frequently misrepresented.

Considering the unique niche filled by laboratory schools in education, training, and research, the lack of awareness and misinformation about them limits their functionality. Laboratory school experts have long called for increased research with more effective dissemination of results and improvement of relations, not only within education departments but also with other university departments. (Goodlad, 1980; Hepburn, 1995; Hunter, 1970). These activities would offer laboratory schools the opportunity to enhance their visibility and build network capital for expanding their own capabilities.

### *A New Opportunity for Partnership*

The University Laboratory School (ULS) at the University of Hawaii at Manoa (UHM) is a school with a research focus. As a part of the Curriculum Research & Development Group (CRDG), ULS is the primary research laboratory for the development and testing of curricula for grades K-12. Originally a normal and training school, ULS served as a teacher training site from 1931 to the mid 1960s. With the formation of CRDG, ULS adopted the research and development focus it retains to this day. In 2001, ULS became a New Century Public Charter School but was able to keep the research mission as part of its charter.

Like many other laboratory schools, ULS is part of a college campus. CRDG is an organized research unit of the College of Education at UHM, however the school no longer plays a major role in teacher training. Yet, ULS has become an essential

component of the training provided for a group of graduate students in the natural sciences.

The Graduate Fellowships in K-12 teaching (GK-12) program is a National Science Foundation (NSF) funding initiative. The GK-12 grants were established in 1999 to provide education training that would complement the research training of graduate students in science, technology, engineering, and mathematics, known collectively as the STEM disciplines. GK-12 fellows receive stipends and cost-of-education allowances that support their collaborations with K-12 educators. These collaborations use the research expertise of the fellows as the foundation for activities to enhance K-12 science curricula.

One of the main objectives of the GK-12 program is to build the communication and teaching skills of the fellows (Mitchell et al., 2003). The collaborative partnerships between the fellows and local teachers provide opportunities for mutual mentoring. The teachers gain experience in cutting edge science while the fellows learn valuable teaching skills. This alternative model of graduate training complements the STEM graduate students' research skills with teaching skills that have been notably lacking in graduate training (DeHaan, 2005; Luft, 2004).

The GK-12 program at UHM began in 1999, in the first cohort of NSF-funded GK-12 programs. Through a series of renewals the program has continued for 10 years and has trained 35 fellows. The UHM GK-12 program is administered through a partnership between the Ecology Evolution & Conservation Biology (EECB) program and the CRDG. The GK-12 fellows at UHM are all students with research interests focused in the EECB content areas. Some of the most cutting edge research in these fields is conducted by EECB faculty and students who are able to take advantage of the relative isolation and unique evolutionary history of the Hawaiian islands, which have formed a natural laboratory for the study of the EECB topics. It is this research that forms the basis of the educational partnerships that the fellows develop with teachers. The role of CRDG in the UHM GK-12 program is to provide training and mentoring for the fellows in addition to preparing and supporting them as they embark on their new K-12 partnerships.

CRDG has provided a particularly unique resource through ULS. The school serves as a demonstration site and practice venue to augment the preparation and training of fellows. ULS has also served as a partnership seedbed, building the foundations for successful programs that have been exported to other schools in Hawaii. These activities have been essential to the success of the UHM GK-12 program, and ULS has played an important role in this major funding effort.

### The Role of ULS in GK-12 Training

#### *Demonstration*

All of the fellows participate in a seminar course designed and administered by CRDG faculty members. The goals of the seminar are to provide the fellows with a background

in current educational research, introduce them to research-based science teaching strategies, and facilitate the development and practice of these teaching strategies. Many of the fellows have little or no previous K-12 teaching experience, and ULS plays a valuable role in their training.

The CRDG model of inquiry-based instruction is exemplified by our curricula and implemented at ULS. This model of disciplinary inquiry requires teaching and learning about a discipline by engaging in the practice of that discipline (King & Brownell, 1966). For scientific inquiry, this means that science teaching and learning mirrors the practice of the scientific discipline. Although the GK-12 fellows are in fact disciplinary experts, they have not experienced disciplinary inquiry in teaching and learning. Observing science classes at ULS provides an image of scientific inquiry instruction.

Fellows are trained by immersion in scientific inquiry activities. Their research experience is complemented by observations of students working through the same activity. For this reason, we selected most of our training activities from CRDG curricula that are taught at ULS.

The opportunities for observation and demonstration at ULS serve another important function. The fellows join the GK-12 program with varied backgrounds in teaching experience. Three of the 35 fellows entered the program with experience as K-12 classroom teachers, but the majority had only taught as University teaching assistants or some had no teaching experience. As the fellows began the process of planning their partnership activities, they were able to sit in on classes at ULS to better understand the types of students they would work with at different grade levels. Observing laboratory school classes allowed fellows to refine their focus and interest in different grade levels and determine with which groups they felt most comfortable.

Although the fellows had disparate teaching backgrounds, they all have strong science backgrounds. And, after being immersed in research science for many years, it is easy to forget what it is like for students to be learning basic scientific concepts for the first time. Classroom observations helped provide an idea of students' developmental levels and what kind of science background they might have. Being able to see what a class of kindergartners, 5<sup>th</sup> graders, or high school sophomores look like and how they function allowed fellows to think through how they would teach content at specific grade levels.

### *Practice*

The involvement of ULS in the GK-12 training system also provided fellows with an opportunity to practice their planned lessons in a safe environment. From the early years of the GK-12 program, ULS classes were made available to individual fellows to try out lessons before putting their ideas into practice in their projects. ULS classes are heterogeneous, selected by a stratified lottery to represent a cross-section of Hawaii's educational population. This means fellows can get a good idea of the kinds of activities that will work well for students of varying backgrounds and ability levels. One caveat to this approach that the fellows have noted over the years is that many schools are not as heterogeneous as ULS. Fellows reported that going from a mixed to a more

homogeneous group, especially in schools in high-poverty areas or with high proportions of special-needs students was challenging. The small school environment of ULS also did not prepare fellows as well for the reality of working with large classes in some of Honolulu's very large high schools (2000 or more students).

In addition to the informal practice provided to fellows on a case-by-case basis throughout the ten years of the UHM GK-12 program, later cohorts of fellows received more formalized opportunities for practice. Fellows in the 2007 cohort requested more opportunities to practice and receive feedback on their teaching. We arranged for them to teach short lessons to a group of ULS 9<sup>th</sup> graders. Pairs of fellows selected nature of science concepts such as hypothesis formation and scientific error. The fellows had two weeks to prepare a lesson and twenty minutes to teach the students. ULS students are accustomed to being observed and to giving feedback on experimental lessons; in this case they took part in the lesson in front of ULS supervisors and GK-12 fellows. The students then gave feedback by completing evaluation forms for each lesson. For the GK-12 fellows, the feedback from a real group of students was an invaluable complement to their peer feedback, which was already an essential element of GK-12 lesson planning. In fact, the fellows cited the experience as one of the most useful aspects of their training in their year-end evaluations.

#### *Success of the UHM GK-12 Model*

The training model outlined above has demonstrated success, measurable in awards and repeated funding from NSF. In 2002 the UHM GK-12 program received a Track II renewal. These GK-12 grants (no longer available under the current GK-12 program structure) were awarded to programs with demonstrated achievements for trial and testing of new activities. In 2006, we were awarded an accomplishment-based renewal by NSF, the only such renewal received by any GK-12 program. Also in 2006, we were included in the NSF report to congress as exemplary and have been invited twice to present the GK-12 training model to attendees of the annual GK-12 meeting. UHM GK-12 PIs were also invited panelists in the AAAS Forum for School Science in 2004, specifically to share the GK-12 training model.

UHM GK-12 fellows have completed the GK-12 program with increased commitments to K-12 education and outreach compared to other EEEB students not participating in GK-12 fellowships (Baumgartner, in prep). A concrete example of this commitment is that two of the authors of this paper (EB & KD) are former GK-12 fellows. Of the 29 fellows who have completed the GK-12 program (6 are still in fellowships), 10 have chosen jobs that emphasize K-12 education compared to 16 who have chosen jobs with an emphasis in research science. The majority of fellows who have progressed through the GK-12 program identified the opportunities for observation and practice at ULS as valuable aspects of their training that should be maintained and even increased. While not statistically significant, it is worth noting that the first cohort of fellows to take part in the formal teaching practice at ULS all engaged in their partnership projects earlier in the year than any previous cohort of fellows.

## ULS as a Partnership Seedbed

The research mission of CRDG is reflected in the ULS charter. The very nature of the school encourages the flexibility to try alternative programs and lessons. This is in contrast to many traditional schools that are feeling increasing pressure due to state and federal mandates. Schools have become less flexible as K-12 standards have become more prescriptive and narrowed in focus, as testing has increasingly driven school activities, and as the response to school performance judged inadequate has become more punitive. Many principals and teachers are understandably concerned about trying an alternative program like GK-12 in their classrooms. ULS has filled the role of a proving ground for activities that might otherwise not make it into schools. Because ULS faculty and students are grounded in action research as part of the school's mission, collection of data on student achievement and interest is often part of the regular school activities.

### *OPIHI*

Our Project in Hawaii's Intertidal (OPIHI) is an example of a project that began at ULS and successfully transitioned to other schools. OPIHI builds students' scientific skills by involving them in field investigations of intertidal biodiversity. The project originated as a partnership between GK-12 fellow Chela Zabin and ULS Marine Science instructor Erin Baumgartner. The original goals of the partnership were to teach students about scientific sampling by training them to collect data on intertidal species richness as part of Dr. Zabin's research (Baumgartner & Zabin, 2008).

The first year of OPIHI demonstrated successful outcomes both in the gathering of scientific data and in student content and skills knowledge gains (Baumgartner & Zabin, 2008). Other schools soon adopted the OPIHI model, using lesson plans developed and tested at ULS. Over six years, the OPIHI project has expanded to more than a dozen schools monitoring intertidal species richness and abundance on four islands. The OPIHI website ([www.hawaii.edu/gk-12/opihi](http://www.hawaii.edu/gk-12/opihi)) contains lesson plans and activities, all originally developed and tested at ULS, which has continued to try new OPIHI lessons and modifications as the project has grown.

### *Forensics*

Another example of a partnership conceived at ULS that expanded to another school is the forensics program developed by GK-12 fellow Toby Daly-Engel and ULS biology teacher Kanesa Duncan. The Senior biology class at ULS focuses on molecular biology and genetics, and the forensics unit was envisioned as a way to engage students in these concepts (Duncan & Daly-Engel, 2006). Students learned and experienced molecular techniques, took field trips to the Hawaii Institute of Marine Biology, the Honolulu Blood Bank and the hospital morgue to see the use of molecular investigation techniques. Students also watched and evaluated episodes of the television series Crime Scene Investigation (CSI) that featured molecular forensics. Following the unit,

the students demonstrated a greater understanding and appreciation of molecular biology and science in general.

The forensics unit was subsequently made available to an AP Biology teacher at another school. This novice teacher was hired with little teaching background. The forensics unit provided a tested program available for immediate use.

## Recommendations

### *Partnership Formation*

Laboratory schools have flexible learning opportunities and are uniquely located on college campuses. They can and should look to the whole campus community to form innovative and dynamic partnerships. In the STEM disciplines, many programs and funding agencies now emphasize broader impacts and outreach. NSF and the National Institutes of Health have both made broader impacts a major criterion for review. The emphasis on broader impacts could be presented to potential partners as a benefit of laboratory school involvement. The teacher training and research missions of laboratory schools both provide opportunities for the broad dissemination of program impacts.

In some cases, laboratory school faculty are also university faculty and can therefore easily serve as a Principle Investigator (PI) on federal, state or foundation grants. Depending on the funder's stipulations, any laboratory school faculty member may be able to serve as a PI or co-PI. When laboratory school faculty act in these roles it emphasizes the relationship of the laboratory school as a partner in the program or activity seeking funding. Partnership formation helps ensure that all organizations in the program contribute and benefit.

Effective partnerships create positive, synergistic results, but they also require a clear vision of the expectations and obligations of each partner. This means that laboratory schools should carefully consider the role they will play in the partnership and what they would like to get out of the interaction. These ideas must be clearly defined in most funding applications – the management structures required in proposals provide a venue in which to outline the partnership roles. When partnerships arise informally, or in circumstances that do not require the development of a management or organizational structure, it is still valuable for all participants to take the time to align their goals and expectations in addition to clearly delineating all responsibilities.

### *Looking Beyond the Campus Community*

While the relationship of many laboratory schools with college campuses may predispose partnerships with academic units, the opportunities presented by community groups to partner should not be overlooked. Many community groups have educational missions that can be met by laboratory school involvement. For example, an effective partnership was formed between CRDG and the Bernice P. Bishop Museum Education through the museum's Cultural and Historic Organizations program. Lessons to support student learning about taxonomy and scientific methodology through a planned museum magnet school was trialed at ULS. Within the UHM GK-12 program, some



fellows have also chosen to work with informal and free-choice learning programs like the Hawaii Nature Center and the Harold L. Lyon Arboretum; these organizations have become additional partners in the UHM GK-12 effort.

Additional venues for partnerships that may be overlooked are public and private schools. In the case of the UHM GK-12 program, the teachers with whom the fellows collaborate are teaching mentors to the fellows. The mentor teachers are also integral partners in the effort. As part of the charter school network, ULS has found opportunities for partnership with other charter schools like Connections Public Charter School on the island of Hawaii. In this partnership, ULS faculty have become involved in professional development and curriculum testing projects with Connections faculty. This professional learning community has provided curricular resources to Connections faculty, who have in turn provided important feedback on the use of those curricula as pilot testers. Some Connections faculty have even become professional development trainers of CRDG programs like Foundational Approaches in Science Teaching (FAST).

### *Sharing Results*

If interested in partnering beyond their current scope, the most important activity any laboratory school can undertake is to publish, present, and otherwise disseminate research-based results of activities. There is a clear need for all laboratory schools to engage in such activities no matter what their function. In the case of partnership building however, these activities build awareness, demonstrate the potential for high-quality activities and clearly show a record of practice that is supported by data. Solely within the STEM disciplines, ULS faculty and staff are currently engaged in thirteen separate partnerships that in some way take advantage of the unique resources of the laboratory school. Many of these partnerships have arisen as the result of dissemination of results from previous partnerships and activities.

Appropriate venues for dissemination are local, national, even international. We have expanded our GK-12 network most effectively by yearly participation in the semi-annual regional meeting of science teachers - the Hawaii Science Teachers' Association (HaSTA). Both GK-12 partnerships that originated at ULS were also published in *The Science Teacher*, the high school journal of the National Science Teachers' Association (NSTA). This widely read publication helped us share our work with a national audience and gain new perspectives beyond our own community. By participating in charter school and laboratory school organizations we have also enhanced our own networks and opportunities to build partnerships while at the same time providing information to similar groups who may benefit from our experience. Although dissemination activities do require some investment of time, energy, and even money, the return of that investment in networking capital is significant.

### Summary

Laboratory schools can realize new opportunities by looking beyond their traditional interactions to academic departments and organizations outside education or child psychology. The partnership between EECB and CRDG/ULS through the UHM GK-12

program built a very successful training model of alternative graduate education. The inclusion of laboratory school faculty as full partners with a clear delineation of what that entails is an essential feature of effective laboratory school partnerships like GK-12. The dissemination of data-driven information about the activities of laboratory schools build networking capital and open new opportunities for partnerships.

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